NSI Inc.

TAWASSUL A. KHAN
C.E.O.

SEP 24 2002
PATENT & TRADEMARK OFFICE 870

2862

NONLINEAR SEISMIC IMAGING, INC.

3200 Southwest Freeway • Suite 2340 • Houston, Texas 77027
713.552.2727 • Fax: 713.521.2873
email: tkhan@houston.rr.com

SENT VIA FACSIMILE 703/872-9318

RECEIVED
SEP 27 2002
TC 2800 MAIL ROOM

September 18, 2002

Toan M. Le, Examiner
Box PATENT APPLICATION
Commissioner for Patents
Washington, DC 20231

RE: Application No. 09/853,190
Applicant Tawassul A. Khan (Inventor)
Titled - Mapping Permeable Reservoir Formations by Measuring the Elastic Nonlinear Interactions of a Seismic Wave as it Propagates through the Reservoir Rock Matrix and its Pore Fluids.

Dear Mr. Le:

Enclosed is the Reply to USPTO Office Action Summary of July 31, 2002 regarding Application No. 09/853,190.

The write-up has been submitted for the intent of making the patent clearer and the claims have been rewritten and modified to be more specific and to remove any ambiguity of these claims by taking out any 'general' terms. Please reconsider the revised claims; we believe we have reduced any uncertainty due to the generic nature of our previously written claims.

Further, we are resubmitting and rewriting the original claim 9 for consideration. This election to resubmit all 9 claims supersedes the provisional election made by Sofia McGuire on July 23, 2002.

Thank you for your consideration in this matter. Please do not hesitate to contact me at 713/942-7926 with any questions.

Sincerely,

Sofia McGuire

OIPE JC79
SEP 24 2002
PATENT & TRADEMARK OFFICE

RECEIVED
SEP 27 2002
TC 2100 MAIL ROOM

REPLY TO USPTO OFFICE ACTION SUMMARY OF JULY 3[illegible], 2002,
RE: APPLICATION NO. 09/853,190

Election/Restrictions

The applicant resubmits the original claim 9 for consideration as a species of the claim that is being submitted. The original claims 1-9 are clarified as follows in italics:

A new method for determining in-situ bulk tortuosity of the interconnected pores of reservoir rock, and estimating the bulk permeability of a reservoir formation between seismic transmitters and seismic receivers, such method comprising 1-7 below:

1. *Transmit a monofrequency signal generated by a seismic transmitter or seismic transmitters and received by a seismic receiver or seismic receivers.*

2. *Analyze the spectral content of the received signal.*

3. *Identify the side lobes of the monofrequency signal that was transmitted.*

4. *The frequency of the side lobes represents (F - Fdrag) and (F + Fdrag) where F is the monofrequency and Fdrag is the frequency of the 'Drag Wave'. These side lobes are generated due to the elastic nonlinear interaction between the monofrequency wave traveling through the rock matrix and the 'Drag Wave' being generated due to the coupling between the matrix and pore fluids.*

5. *Calculate the velocity of the 'Drag Wave' Vdrag by using the Doppler Effect in which Fdrag/F = Vdrag/(V – Vdrag); where Fdrag is the frequency of the 'Drag Wave' (see 4 above), F is the monofrequency, Vdrag is the velocity of the 'Drag Wave' and V is the velocity of the monofrequency signal.*

6. *The bulk tortuosity of the inter-well reservoir rock formation can be estimated by: Vdrag = Vfluid/$\sqrt{T}$, where Vdrag is the velocity of the 'Drag Wave', T is tortuosity, and Vfluid is the compressional velocity of the pore fluids.*

7. *Once bulk tortuosity has been estimated, bulk permeability can be estimated using Scheidegger's equation $K = \varphi r^2 / 8T$ or other equations generated by Kelder or Peeters.*

8. *The method of claims 1-7 specifically used to determine in-situ bulk tortuosity of the interconnected pores of reservoir rock, and estimating the bulk permeability of a reservoir formation connected between two wells.*

9. *The method of claims 1-7 specifically used to determine in-situ bulk tortuosity of the interconnected pores of reservoir rock, and estimating the bulk permeability of a reservoir formation in a well between two depth points in that well.*